

RESEARCH NOTES

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EFFECT OF LOGGING ON UNDERSTORY VEGETATION AND DEER USE IN A PONDEROSA PINE FOREST OF ARIZONA

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Ponderosa pine forests of Arizona and New Mexico provide summer habitat for deer and other game animals. They also have high value for timber production. These forests are being logged by a selection system of cutting. This note gives preliminary results of a study designed to determine some of the effects of timber harvest on understory vegetation and deer use. Data and conclusions are specific only for the area studied, thus proposals for improving deer habitat by altering timber management practices may be modified by further study.

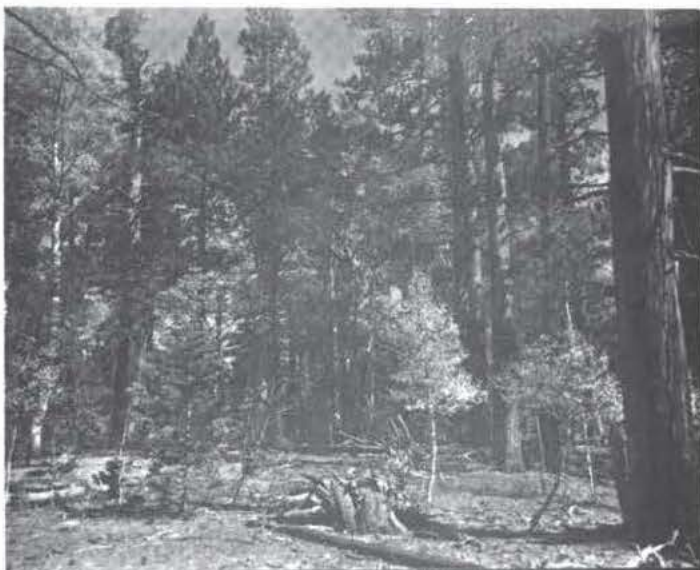
STUDY AREA

The study was conducted on the Big Springs working circle on the North Kaibab Plateau of the Kaibab National Forest. Elevation is about 8,000 feet. General drainage toward the west has produced a series of ridges with definite north and south aspects. Ponderosa pine characterizes south slopes and ridgetops, while Douglas-fir and white fir dominate on north slopes. Logging began in 1951 and one or more ridges were logged annually.

METHODS

Vegetation and deer use were sampled in unlogged forests and in forests that had been logged in each of the following years: 1951, 1954, 1956, 1958, 1960, 1961 (fig. 1).

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Unlogged.



Logged in 1951.



Logged in 1958.

Figure 1.--General
ridgetop views of
sampling areas.

Samples were stratified by topographic sites (north and south slopes, and ridgetops) and forest structure (mature trees, pole-size stands, and openings of at least 1/10 acre).

Understory vegetation was estimated in pounds per acre on 96-square-foot plots in the following classes: (1) sedges, (2) perennial grasses, (3) forbs, and (4) aspen. Estimates were converted to an air-dry basis. Accumulated deer pellet groups were counted on 100-square-foot plots as a measure of deer use.

RESPONSE OF UNDERSTORY VEGETATION TO LOGGING

PERIOD OF RESPONSE

Vegetative response on the logged and unlogged areas was compared. During the first year after logging, forbs and aspen sprouts increased, but sedges and perennial grasses produced less, possibly because of mechanical disturbance during logging (fig. 2).

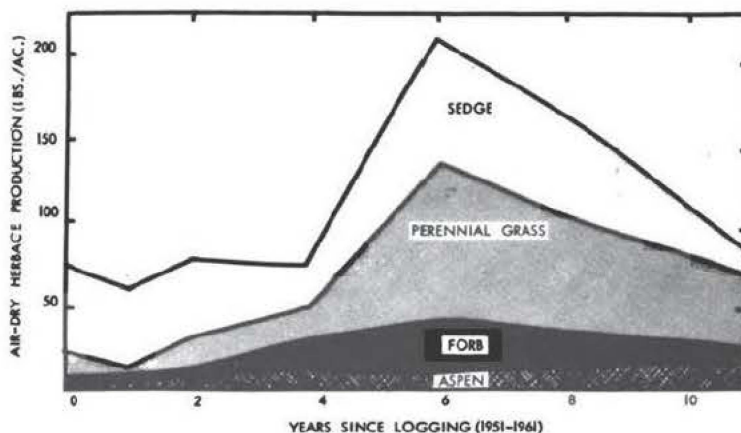


Figure 2. --Production of four classes of understory vegetation as related to years after logging.

From the second through the sixth year, production of all classes--sedges, perennial grasses, forbs, and aspen sprouts--increased annually. Thereafter, all classes declined in production except aspen sprouts, which were still increasing 11 years after logging.

Production of the four classes of understory vegetation on unlogged areas is compared below with that on areas logged 11 years previously.

	<u>Unlogged area</u>	<u>Eleven years after logging</u>
	(Pounds per acre, air-dry)	
Sedges	50	15
Perennial grasses	15	35
Forbs	5	15
Aspen	<u>2</u>	<u>20</u>
Total	72	85

At the end of 11 years, total production of understory herbage was still slightly higher on the logged area. Sedges were the only forage class that produced less on the logged areas. If a constant rate of decline is assumed, production of forbs and perennial grasses would be comparable on both areas in about 15 years. Aspen would also become unavailable at about the same time, because the trees would have grown out of reach of browsing animals. The tentative conclusion seems justified that production of understory vegetation on selectively logged ponderosa pine lands on the North Kaibab can be expected to exceed that on unlogged lands for a period of 11 to 15 years.

ASPECT EFFECTS

For the average of all sampling areas, both logged and unlogged, differences in production among forage classes by aspects were as follows:

	<u>North</u>	<u>Ridgetop</u>	<u>South</u>
	(Pounds per acre, air-dry)		
Sedges	55	35	50
Perennial grasses	40	25	45
Forbs	10	10	25
Aspen	<u>15</u>	<u>15</u>	<u>2</u>
Total	120	85	122

North and south slopes yielded about equal amounts of understory vegetation per unit area; the average was 120 pounds per acre. Ridgetops produced about two-thirds as much as slopes. Aspen production on ridgetops exceeded that on south slopes, however, and forb production equaled that of north slopes. South slopes were lowest in aspen production but highest in yields of forbs.

OVERSTORY EFFECTS

Abundance of forest overstory was measured as basal area. For the average of all the pole-size stands under study, production of all classes of understory vegetation gradually decreased as basal area increased (fig. 3).

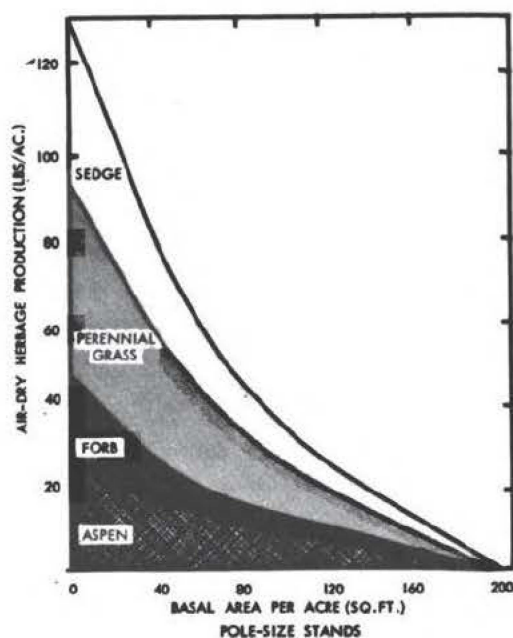


Figure 3. --Relation between production of understory vegetation by forage class (sedges, perennial grasses, forbs, and aspen) and basal area of pole-size stands of coniferous timber.

At 200 square feet of basal area per acre, no understory vegetation was measured. At 140 square feet of basal area, production of understory vegetation was 20 pounds per acre. At 80 square feet of basal area, production of understory more than doubled to nearly 50 pounds per acre.

Some forests are now being thinned to 80-100 square feet of basal area per acre for timber stand improvement. This practice should favor production of understory vegetation. Whether heavier thinning would be consistent with timber management objectives, and would favor deer use, remains to be determined.

There was no apparent relation between basal area of residual forest stands of mature trees and total forage production. Average production of understory vegetation for all study areas, however, was slightly greater under residual stands than under either small openings or stands of pole-size timber, as shown by the following tabulation:

	<u>Mature stands</u>	<u>1/10-acre openings</u>	<u>Pole-size stands</u>
	(Pounds per acre)		
Sedges	100	50	20
Perennial grasses	60	55	30
Forbs	30	65	25
Aspen	<u>50</u>	<u>45</u>	<u>10</u>
Total	240	215	85

Pole-size stands produced about one-third the understory vegetation of mature stands and openings. Production of sedges and forbs differed between mature stands and openings--mature stands produced more sedges and openings more forbs.

DEER USE

RESPONSE TO LOGGING

Except for the first 2 years after logging, deer use, as measured by accumulated pellet groups, was greater on logged than on unlogged areas. During the first 2 years after logging, pellet groups averaged 74 per acre as compared to 118 per acre on the unlogged area. During the remaining 9 years after logging, accumulated pellet groups averaged 896 per acre. Tentative conclusions are that: (1) deer use may be lowered for the first 2 years after logging; (2) after this period deer use may be increased by logging activities; and (3) increased use by deer after logging may last for more than 9 years.

OVERSTORY EFFECTS

Deer use, as measured by pellet groups, tended to reflect the amount of understory vegetation present in overstory classes, as shown by the following tabulation. The data are averages for all situations sampled:

<u>Cover class</u>	<u>Total forage</u> (Pounds per acre)	<u>Pellet groups</u> (Number per acre)
Mature stands	240	697
Openings	215	479
Pole-size stands	85	44

Mature residual stands were slightly preferred over openings, and deer tended to avoid dense, pole-size stands of timber. This suggests that factors other than understory vegetation may influence use of an area by deer.

TOPOGRAPHIC EFFECTS

Deer use varied by aspect. When all sampling situations were averaged, north and south slopes had equal forage production (120 pounds per acre) and equal numbers of pellet groups (475 per acre). Ridgetops showed less deer use per unit of forage produced than the other aspects--80 pounds of forage per acre with only 218 pellet groups per acre. Apparently north and south slopes not only produce the greater amount of forage per unit area, but also are preferred areas for deer. Thus, north and south slopes would seem to offer greater opportunities than ridgetops for habitat improvement.

FORAGE PREFERENCES

Association of pellet groups with the different classes of forage was attempted to determine possible feeding preferences. Relations were not strong for any forage class. Best relations of deer use were shown with aspen sprouts and forbs. Poorest relations were found with perennial grasses and sedges.

MANAGEMENT IMPLICATIONS

Additional data will be required before firm recommendations can be made for improving deer habitat on the North Kaibab Plateau by means of timber harvesting. Even so, present data suggest several management possibilities that seem to warrant further study. These are:

1. Where there is a remnant of understory vegetation, particularly forbs and aspen sprouts, logging might be used to improve forage conditions for deer.
2. By adjusting length of timber cutting cycles with peak production of understory vegetation after logging, it might be possible to maintain greater amounts of understory vegetation for deer.
3. Thinning of dense stands of pole-size timber should benefit understory vegetation, and should increase use by deer.
4. North aspects should have the greatest potential for habitat improvement because timber is most dense here, and possibilities for response of understory vegetation are the highest.

SUMMARY

Logging activities in ponderosa pine forests on the North Kaibab influence understory vegetation. During the first year after logging, perennial grasses and sedges are reduced, but forbs and aspen sprouts are increased slightly. Understory vegetation reaches peak production about 6 years after logging, and continues higher than on unlogged areas for at least 11 and possibly up to 15 years. Ridgetop aspects and dense pole-size stands of timber produce the least understory vegetation.

Deer use, as measured by accumulated pellet groups, was lower on logged than on unlogged areas for the first 2 years after logging. Between 3 and 11 years after logging, however, deer use was several times higher on logged areas. Deer use was found to be comparatively low in pole-size timber, on ridgetops, and where perennial grasses and sedges dominated the understory.

Implications from findings for improving deer habitat on the North Kaibab by adjusting timber harvest would include: (1) shifting areas of logging to benefit deer populations, (2) shortening timber cutting cycles to keep forage production high, (3) thinning of pole-size stands to increase herbaceous understory, and (4) reducing density of timber on north aspects.